

## 2.5

### Exponent Laws II

#### FOCUS

- Understand and apply exponent laws for powers of: products; quotients; and powers.

A power indicates repeated multiplication.

What is the standard form of  $(2^3)^2$ ? How did you find out?

$(2^3)^2$  is a **power of a power**.

The base of a power may be a product; for example,  $(2 \times 3)^4$ .

$(2 \times 3)^4$  is a **power of a product**.

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#### Connect

##### ► Exponent Law for a Power of a Power

To raise a power to a power, multiply the exponents.

$$(a^m)^n = a^{mn}$$

$a$  is any integer, except 0.

$m$  and  $n$  are any whole numbers.

EXAMPLE:

$$(3^2)^4$$

$$(-5^3)^6$$

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**Example 1** Simplifying a Power of a Power

Write as a power.

a)  $[(-7)^3]^2$

b)  $-(2^4)^5$

c)  $(6^2)^7$

**SOLUTION:**

a)  $[(-7)^3]^2$

b)  $-(2^4)^5$

c)  $(6^2)^7$

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**YOU TRY!**

Write as a power

**SOLUTION:**

a)  $[(-6)^2]^5$

b)  $(-4^5)^9$

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## Connect

We can use this result to write an exponent law for the power of a product.

### ► Exponent Law for a Power of a Product

$$(ab)^m = a^m b^m$$

$a$  and  $b$  are any integers, except 0.

$m$  is any whole number.

EXAMPLE:  $(3 \times 4)^3$

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### EXAMPLE 2: Evaluating Powers of Products and Quotients

Evaluate:

a)  $[(-7) \times 5]^2$

b)  $-(3 \times 2)^2$

**SOLUTION:**

a)  $[(-7) \times 5]^2$

b)  $-(3 \times 2)^2$

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## YOU TRY!

Evaluate each expression

**SOLUTION:**

a)  $\left[(-8) \times 4\right]^3$

b)  $\left[(-3 \times 2)\right]^4$

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### EXAMPLE 3: Applying Exponents Laws and Order of Operations

Simplify, then Evaluate:

a)  $\left(3^2 \times 3^3\right)^3 - \left(4^3 \times 4^2\right)^2$

**SOLUTION:**

a)  $\left(3^2 \times 3^3\right)^3 - \left(4^3 \times 4^2\right)^2$

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### EXAMPLE 3: Applying Exponents Laws and Order of Operations

Simplify, then Evaluate:

b)  $\left[(-5)^3 + (-5)^4\right]^0$

**SOLUTION:**

$$\left[(-5)^3 + (-5)^4\right]^0$$

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### YOU TRY!

Simplify, then evaluate

**SOLUTION:**

$$\left[(-6)^3 + (-6)^5 \div (-6)^2\right]^3$$

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### Discuss the ideas

1. Why do you add the exponents to simplify  $3^2 \times 3^4$ , but multiply the exponents to simplify the expression  $(3^2)^4$ ?
3. In *Example 3*, is it easier to key the original expressions in a calculator or use the exponent laws to simplify first? Justify your answer.

### Reflect

Design and create a poster that summarizes all the exponent laws you have learned. Provide an example of each law.

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### Practice

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